

CLAIMS

1. A laser diode apparatus comprising:

a substrate having first and second major surfaces;

a plurality of grooves formed in the first major surface of the substrate, wherein at least a first one of the plurality of grooves serves as a cooling channel through which coolant flows to cool the substrate; and

a laser diode bar located in at least a second one of the plurality of grooves, wherein the first groove is in close proximity to the second groove.
2. The laser diode apparatus according to claim 1, wherein a metallization layer is formed on side walls of the second groove.
3. The laser diode apparatus according to claim 1, wherein a metallization layer is formed on walls defining the first groove.
4. The laser diode apparatus according to claim 1, wherein the first groove is one of a plurality of grooves serving as cooling channels through which coolant flows to cool the substrate, and the second groove is one of a plurality of grooves in which laser diode bars are respectively located.
5. The laser diode apparatus according to claim 4, wherein the grooves that form cooling channels are parallel to the grooves in which laser

diode bars are respectively located, and the grooves that form cooling channels are alternated with the grooves in which laser diode bars are respectively located.

6. The laser diode apparatus according to claim 1, wherein the laser diode apparatus is surrounded by a housing, and the housing includes a window that is opposed to an emitting face of the laser diode bar.

7. The laser diode apparatus according to claim 6, wherein a space exists between the laser diode apparatus and the housing, coolant flows through the space, and the space communicates with the cooling channel.

8. The laser diode apparatus according to claim 7, wherein an inlet is formed in the housing to conduct coolant into the housing, and an outlet is formed in the housing for permitting coolant to exit the housing.

9. The laser diode apparatus according to claim 8, wherein the inlet is located on a first side of the housing, the outlet is located on a second side of the housing, which is opposite to the first side of the housing, and the substrate is arranged in the housing such that the grooves extend from the first side of the housing to the second side of the housing and such that the cooling channel is aligned with the direction of coolant flow.

10. A monolithic laser diode array comprising:

a monolithic substrate having upper and lower major surfaces and at least a first groove and a second groove formed in the upper major surface along a length of the substrate, wherein the first and second grooves have side walls formed vertically in the substrate;

a metallization layer formed along the side walls of the first and second grooves to form metallized grooves; and

a plurality of laser diodes located in the first metallized groove, wherein the second groove forms a cooling passage for cooling the laser diode array.

11. The laser diode array according to claim 10, wherein the first groove is one of a plurality of grooves serving as cooling channels through which coolant flows to cool the substrate, and the second groove is one of a plurality of grooves in which laser diodes are located.

12. The laser diode array according to claim 11, wherein the grooves serving as cooling channels are parallel to the grooves in which laser diodes are located, and the grooves that form cooling channels are alternated with the grooves in which laser diodes are located.

13. The laser diode array according to claim 10, wherein the laser diode array is surrounded by a housing, and the housing includes a window that is opposed to emitting surfaces of the laser diodes.

14. The laser diode array according to claim 13, wherein a space exists between the laser diode array and the housing, coolant flows through the space, and the space communicates with the interior of the groove serving as a cooling channel.

15. The laser diode array according to claim 14, wherein an inlet is formed in the housing to conduct coolant into the housing, and an outlet is formed in the housing for permitting coolant to exit the housing.

16. The laser diode apparatus according to claim 15, wherein the inlet is located on a first side of the housing, the outlet is located on a second side of the housing, which is opposite to the first side of the housing, and the laser diode array is arranged in the housing such that the grooves extend from the first side of the housing to the second side of the housing and such that the cooling channel is aligned with the direction of coolant flow.

17. A method of forming monolithic laser diode arrays, the method comprising:

providing a monolithic substrate;

forming a first groove and a second groove in the monolithic substrate such that the first groove is adjacent to and parallel to the second groove;

forming side walls of the first and second grooves vertically in the monolithic substrate; and

depositing a metallization layer along at least the side walls of the first groove to form a metallized groove;

setting a plurality of laser diodes in at least the first groove, such that a radiation emitting surface of each of the plurality of laser diodes is parallel to the major surface of the substrate; and

leaving the second groove vacant to serve as a cooling channel to facilitate heat transfer from the laser diodes.

18. A method as claimed in claim 17, wherein the method includes forming a plurality of grooves that include the first groove and the second groove such that the first groove is one of a plurality of grooves that hold laser diodes, and the second groove is one of a plurality of vacant grooves, wherein the vacant grooves are alternated with the grooves that hold laser diodes.